Introduction to D4Science
VRE concepts and common Services to support the entire research cycle

Title

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IR0000032 – ITINERIS, Italian Integrated Environmental Research Infrastructures System
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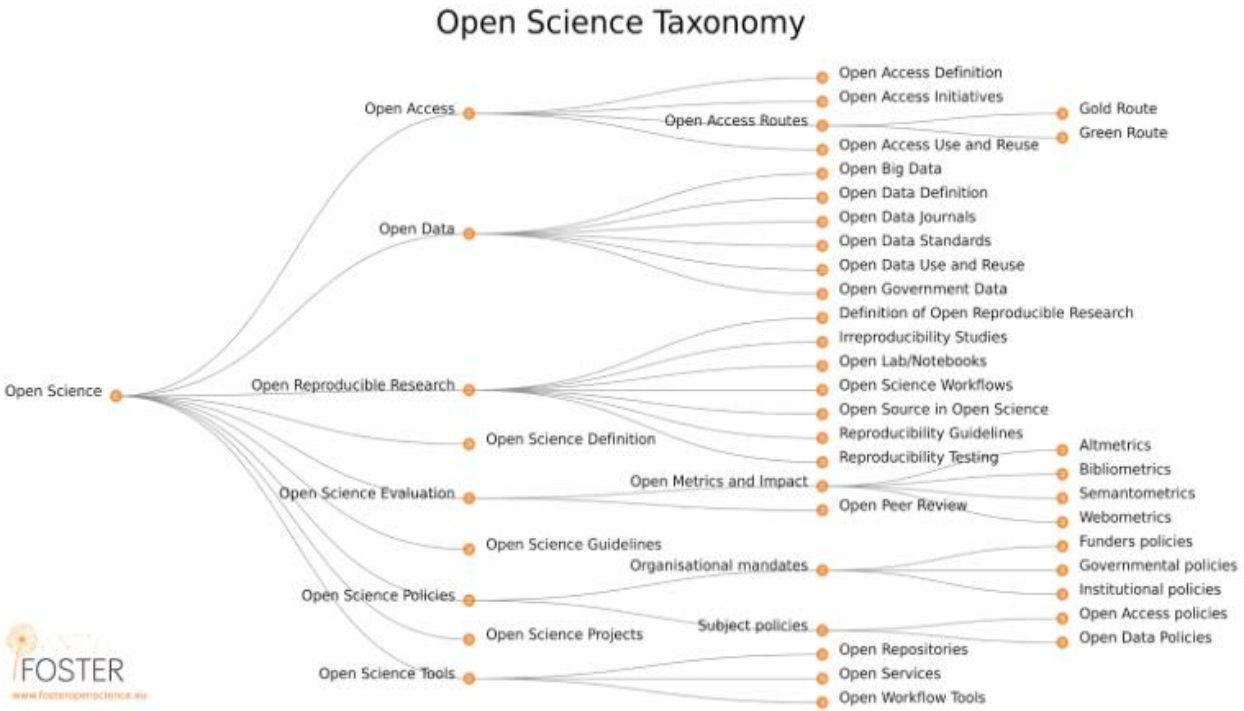
What is Open Science?

An approach to the scientific process based on cooperative work and ways of disseminating knowledge, improving accessibility to and re-usability of research outputs by using digital technologies and collaborative tools.

SOURCE: COMMISSION RECOMMENDATION (EU) 2018-790 of 25 April 2018



Open Science Infrastructures

What is an Open science infrastructure?

A shared research infrastructure that support open science and serve the needs of different communities.

It can be physical, digital and hybrid, include publication and data repositories, equipment and other infrastructures for open **sharing**, **evaluation** and **reproducibility.**

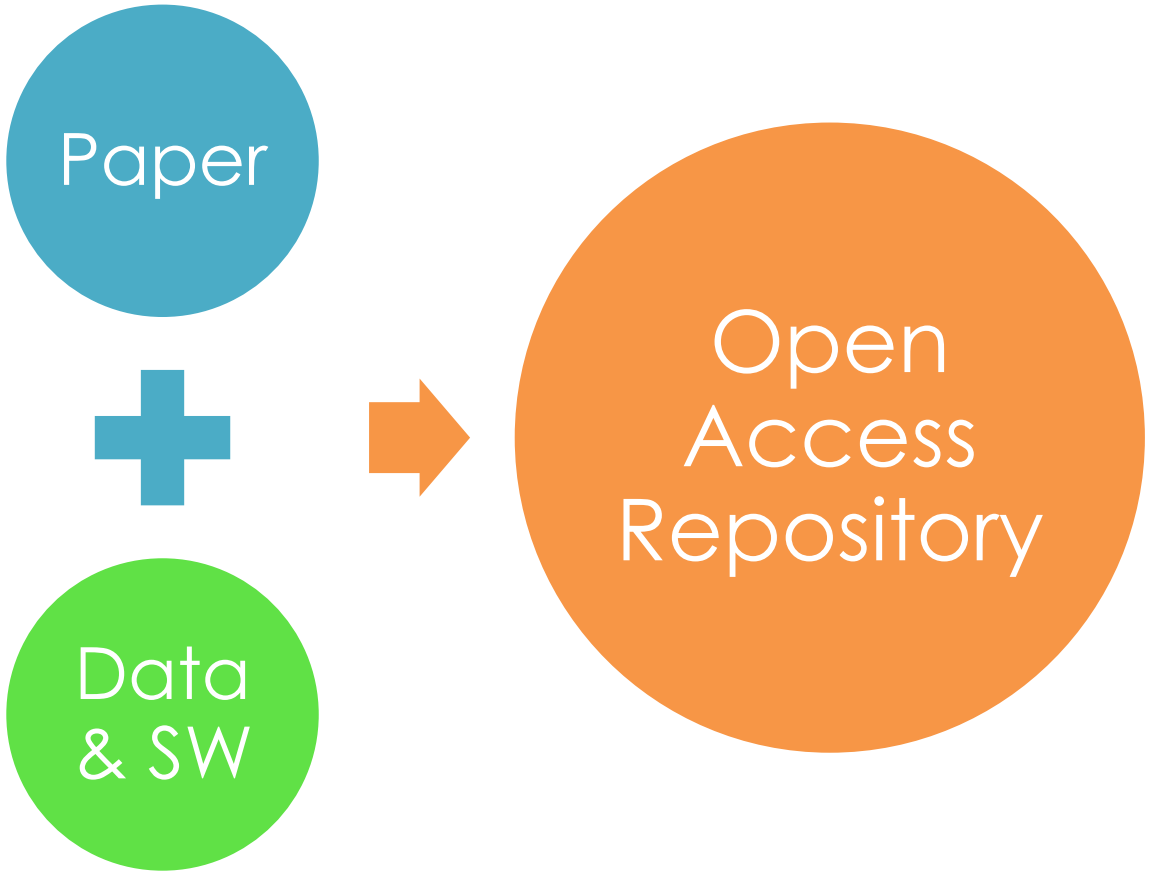
Not only Open Access Repositories…

Repositories typically address a specific part of the research workflow, while infrastructures are relevant across the entire research cycle.

UNESCO, 2023, Open Science Outlook 1

Open Science practices today:

Deposit in Open Access Repository



external to the “research place”

- Slow and Complex to Collaborate, Reuse and Evaluate Results

Data Driven and e-infrastructure Research Context

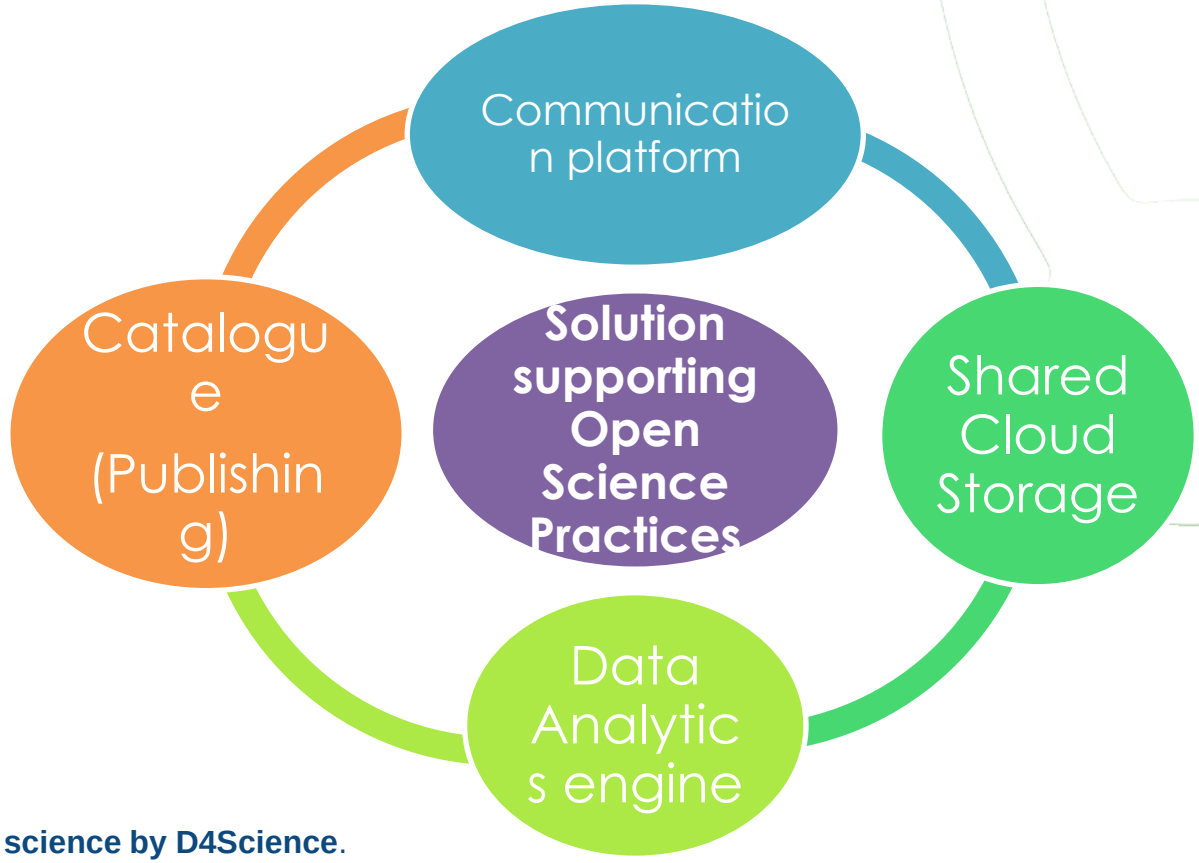
- Data-Driven Scientific Activities
- e-infrastructure

- Providing user with direct access to the “place” where the research activity is performed.

Paradigm shift:

coupling of the “place” where research is performed with the “place” where research is communicated

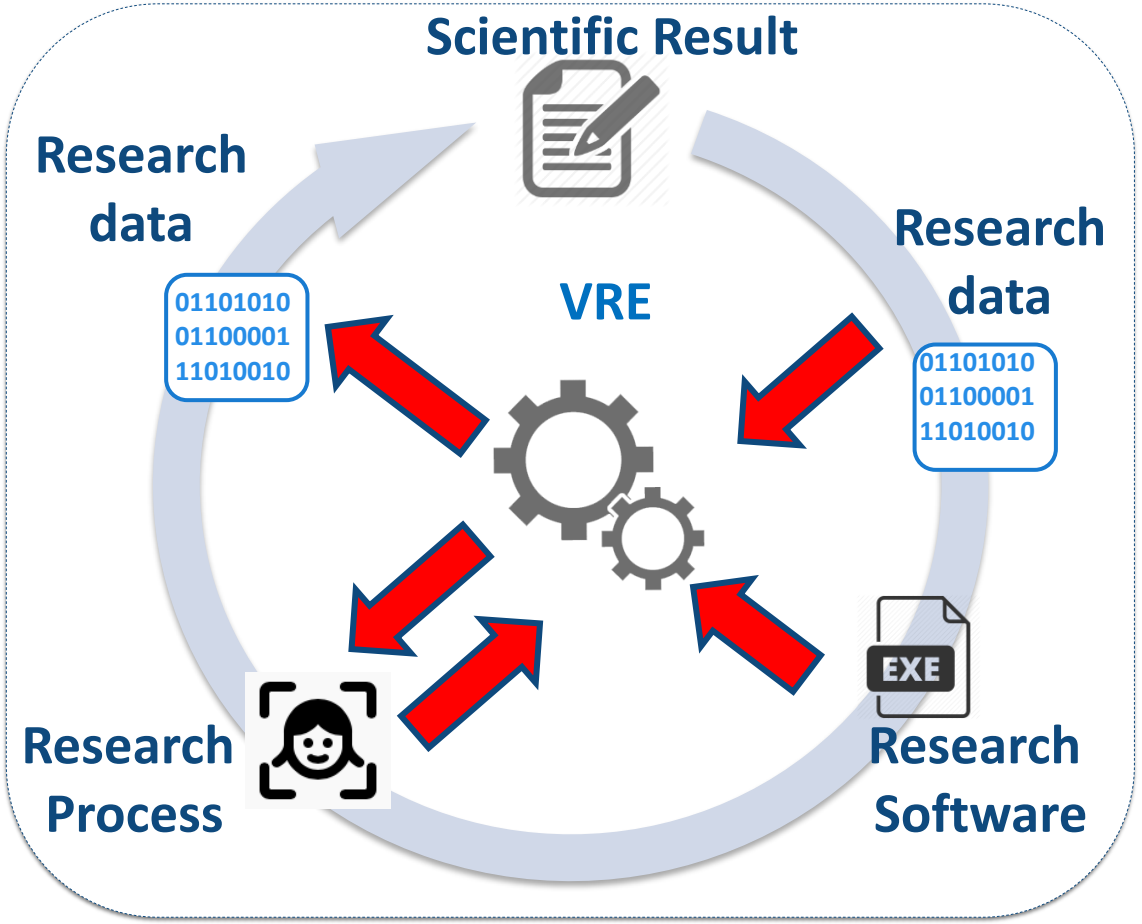
The VRE makes it possible to do more, supporting the entire (data-driven) research lifecycle



M. Assante, et al. (2019) **Enacting open science by D4Science**.
Future Generation Computer Systems (Vol. 101) doi: 10.1016/j.future.2019.05.063

M. Assante et al. (2023**) Virtual research environments co-creation: The D4Science experience.**
Concurrency Computat Pract Exper. 2023; 35(18):e6925. doi:10.1002/cpe.6925

VRE as a platform to support and promote Open Science practices



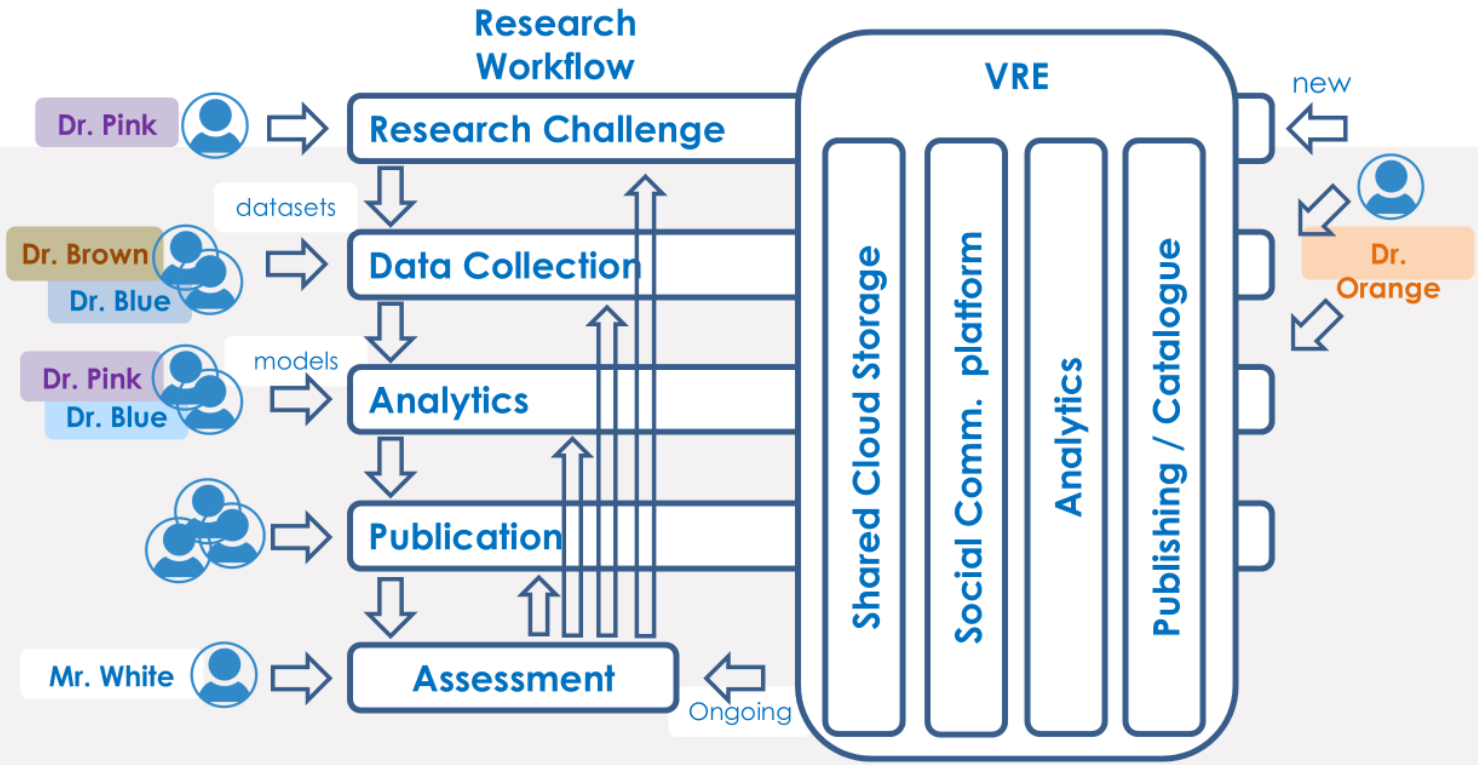
Enable

- Reproduce, Reuse, Evaluate
- Active collaboration
- Effective sharing
- Provenance and attribution

Adopt

- As-a-service approach
- Standards
- Economy-of-scale to reduce operational costs

A prototypical and simplified scientific workflow enacted by these components



All of this happens well before their paper is published!

VRE platform based on D4Science

- D4Science is a federated digital infrastructure promoting Open Science
- 4 sites (1 Pisa, 3 @ GARR)
- 6.900 CPUs core
- 29 TB RAM
- 1.400 TB Storage

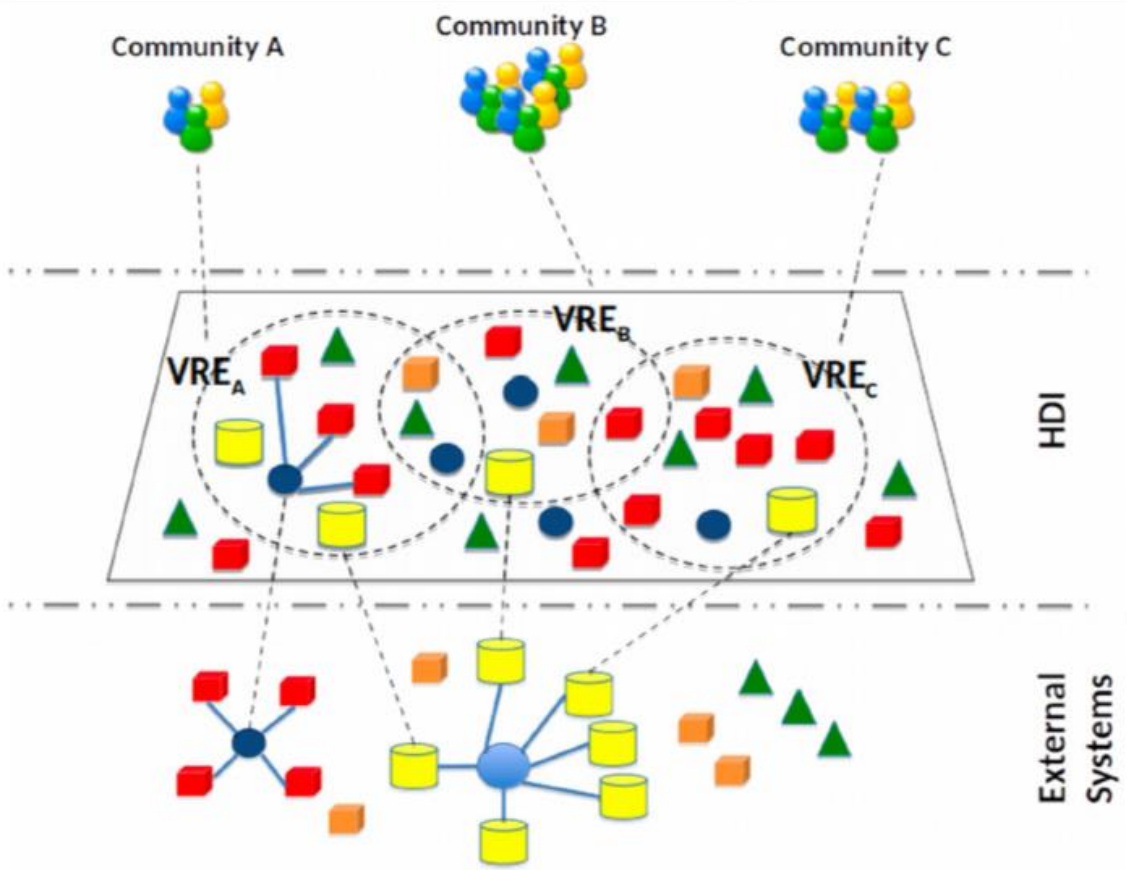
D4Science is owned and managed by CNR (ISTI)

It supports ESFRI RIs, national and European projects, national and international initiatives

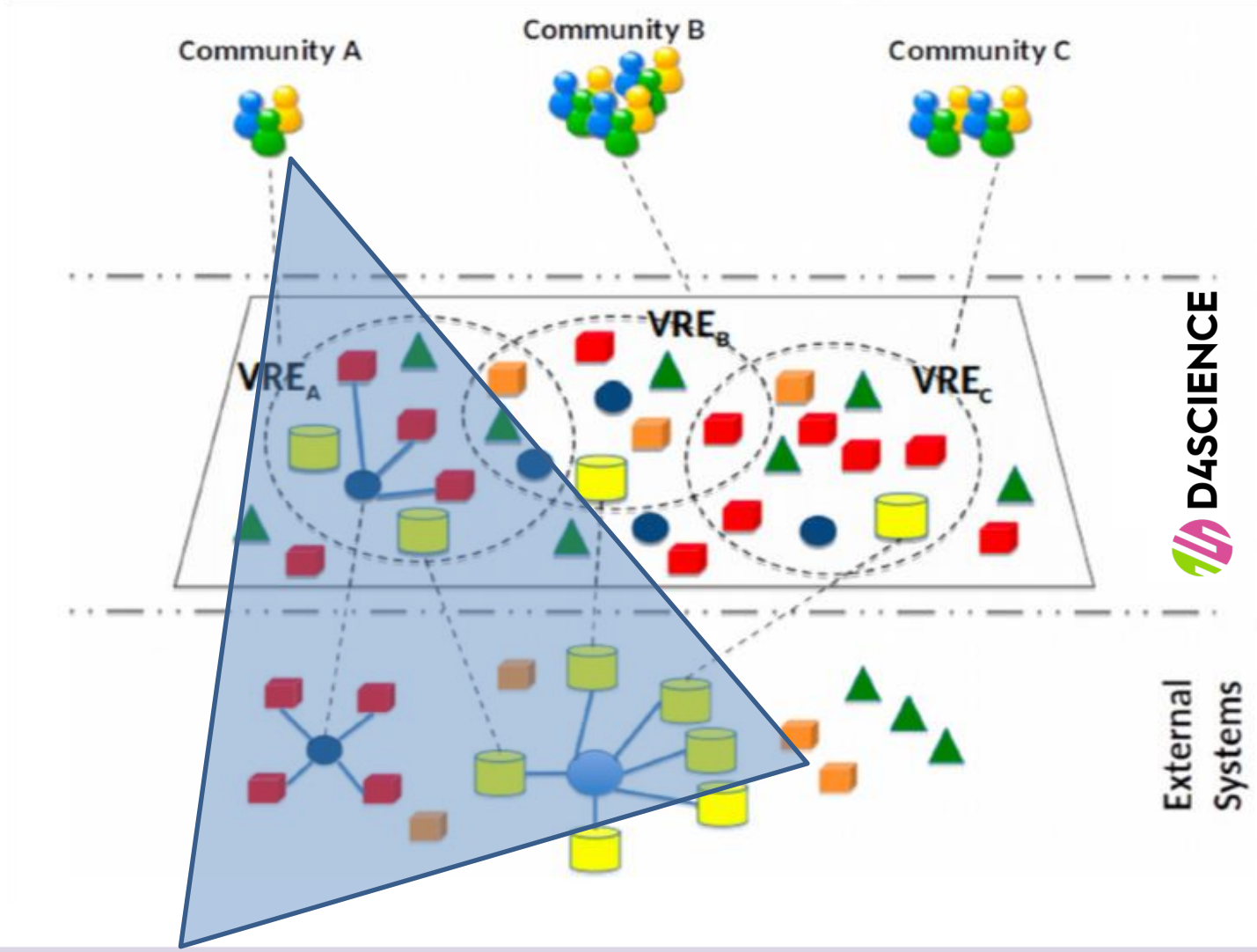
ITINERIS VRE platform based on D4Science

D4SCIENCE promotes Open Science practices through the operation of a digital Infrastructure service

- leverage **external systems** (e.g. data, storage services, computational resources, cloud computing infrastructures)
- by exposing them as a **common unified space of resources**
- to serve **diverse community of researchers**
- via the **provision of tailored services and sharing tools**
- made accessible through a flexible, web-based and on-demand environments called **VREs or Virtual Labs**



ITINERIS VRE platform on D4Science



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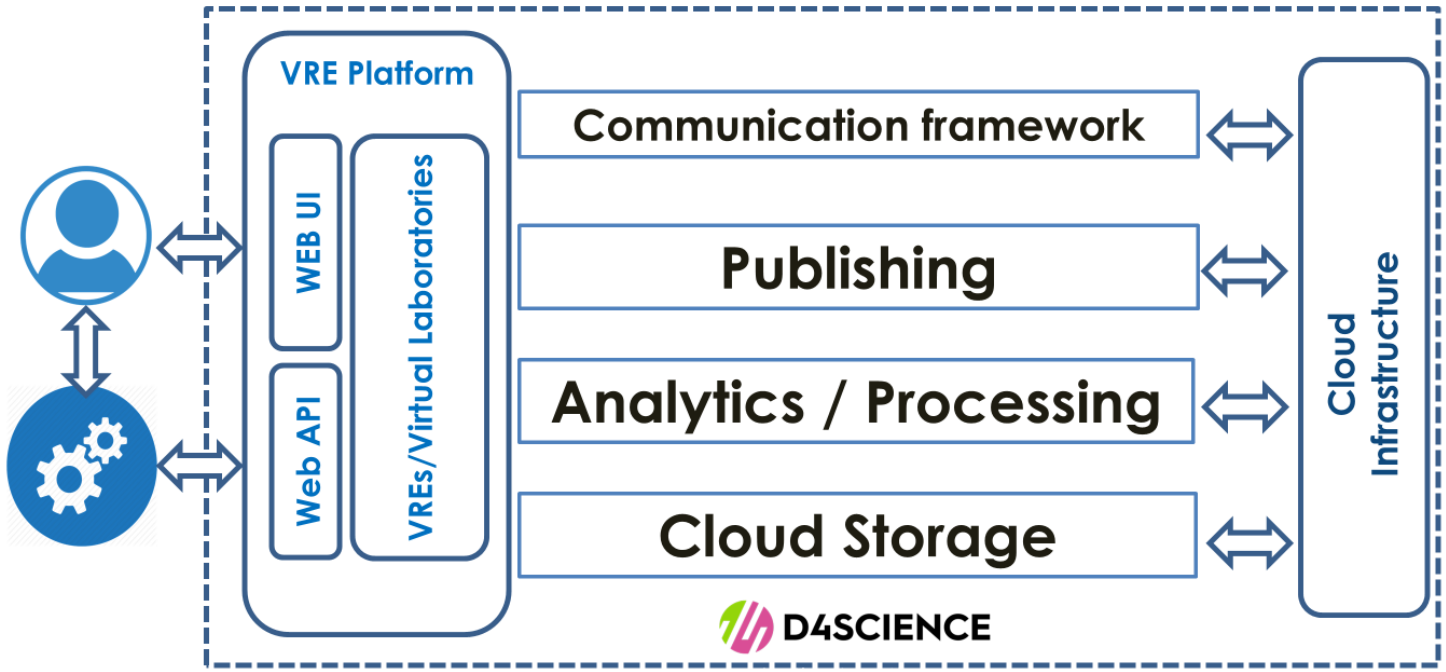
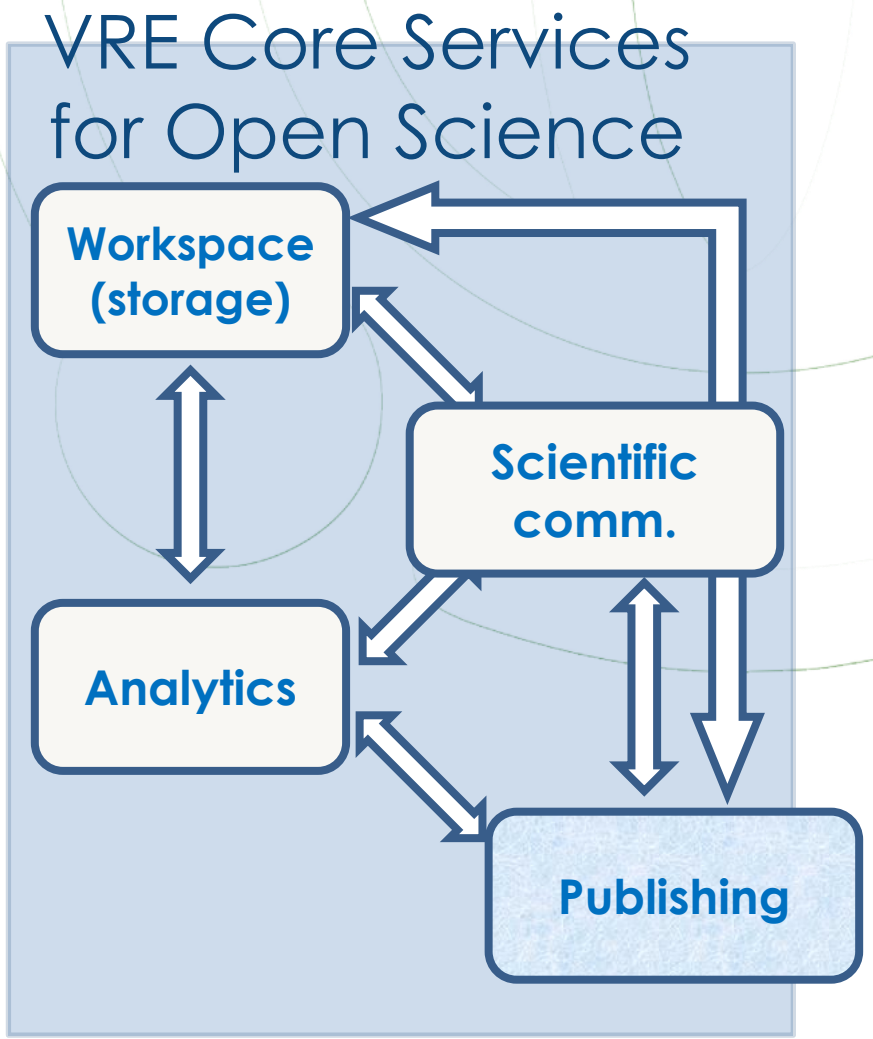
ITINERIS VRE Open Science Services for Virtual Lab tools



VRE tools

VLab tools

- Highly Configurable Jupyter Notebook env.
- Rstudio Version 4+ env.
- (R) Shiny Apps
- Analytics Engine
- Custom Service/Apps



THANKS!

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